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Expert Report of Dr. Glen E. Farr, PharmD In City of Chattanooga v. Mykel Jenkins

Prepared at the request of:
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Via Email: pnoblett@chattanooga.gov

In the matter set out above involving Mr. Mykel Jenkins, I was asked to give an expert opinion on the pharmacological and toxicological effects of methamphetamine and ethanol.

Qualifications and Background for Glen E. Farr, Pharm.D.

I received a B.S. in Pharmacy and Doctor of Pharmacy degrees from the University of Tennessee College of Pharmacy in Memphis. Following graduation, I was appointed to the faculty and served as Professor of Clinical Pharmacy and Associate Dean for 46 years. I currently serve as Professor Emeritus of Clinical Pharmacy and Translational Science. I have been a licensed pharmacist in the state of Tennessee since 1972.

In addition to responsibilities for pharmacy continuing education offered throughout the State of Tennessee, I teach pharmacy students, and undergraduate and graduate nursing pharmacology courses at UT Knoxville. I also serve as a consultant pharmacist to physicians and health-care entities. I have written more than 50 articles in the professional literature, authored or edited more than 20 books or educational courses, and presented more than 600 papers/speeches locally, nationally and internationally.

I am a past President of the Tennessee Pharmaceutical Association, was the 1983 "Pharmacist of the Year" for the State of Tennessee, and in 1997 received the "Distinguished Service to Pharmacy" award from the Tennessee Society of Hospital Pharmacists.

In 2002, I received the University of Tennessee National Alumni Association "Teacher of the Year Award" and in 2007 was named the University of Tennessee College of Pharmacy "Outstanding Alumnus." In 2016, I was voted "Outstanding Classroom Teacher" by the University of Tennessee College of Nursing, Class of 2016. In 2019, I was recognized by Tennessee Senate Resolution #325, honoring 45 years of service to the University of Tennessee and Pharmacy practice in Tennessee.

I have reviewed numerous cases (estimate of >50) over the past 40 years involving the pharmacological and toxicological effects of opioids, methamphetamine, cocaine, cannabinoids, ethanol ("alcohol") and other drugs/substances. I have testified in State and Federal courts in several states regarding the effects of these agents and have not had my opinions disqualified.

Materials Reviewed in this Matter

- OIS CPD Complaint Number 21-007022
- Office of Hamilton County Medical Examiner Southeast Tennessee Regional Forensic Center Report of Steven C. Cogswell, M.D.
- NMS Labs Toxicology Report for Mykel D. Jenkins
- Baselt, *Disposition of Toxic Drugs and Chemicals in Man*, 12th edition
- Baselt, *Drug Effects on Psychomotor Performance*
- Clarke's *Analytical Forensic Toxicology*
- Winek's *Drug and Chemical Blood Level Data*, 2001
- "Concentrations of Scheduled Prescription Drugs in Blood of Impaired Drivers: Considerations for Interpreting the Results," Jones, et al., *Therapeutic Drug Monitoring. 29(2):248-260, April 2007*
- Micromedex
- NMS Labs
- Silber, et. al., "The effect of *d,l*-methamphetamine on simulated driving performance," *Psychopharmacology* (2012) 219:1081–1087
- Logan BK, "Methamphetamine and Driving Impairment," *J Forensic Sci*, 1996, 41(3):457-64
- Advokat C, Comaty J, Julien R. *Julien's Primer of Drug Action*. 13th ed. New York, NY: Worth Publishers; 2014

Brief History and Toxicology Report

On Friday, March 19, 2021, Mr. Jenkins was at his mother's residence when she called Hamilton County 911 at 1030 hours to report a domestic dispute. Two Chattanooga Police Department officers responded to the scene. Mr. Jenkins produced a weapon while inside the residence resulting in him being tasered by one of the police officers. Non-lethal efforts were unsuccessful, the officer discharged his service weapon at 1049 hours. Hamilton County EMS arrived on scene at 1055 hours. Mr. Jenkins was unresponsive and pulseless, ACLS was started, and CPR began at 1057 hours.

Mr. Jenkins was transported to Erlanger Hospital, arriving at 1123 hours in asystole. Multiple gunshot wounds were noted on the face, chest, and right arm. The decedent was pronounced by Dr. Jillian Scott at 1126 hours. At 1221 hours, Hamiliton County Sheriff's Office notified the Hamilton County Medical Examiner's Office of a death that occurred in Erlanger Hospital's Emergency Department. The cause of death was listed as "Multiple gunshot wounds" and the matter of death was "Homicide."

Qualitative urine drug screen for the common drugs of abuse was done at the time of autopsy. It was positive for methamphetamine and amphetamine. Confirmatory testing and quantitation on blood and vitreous fluid (NMS Report 21099252) revealed the following:

- Methamphetamine (2100 ng/ml in blood, 1700 ng/ml in vitreous fluid)
- Amphetamine (64 ng/ml in blood, 49 ng/ml in vitreous fluid)
- Ethanol (11 mg/dl in blood - a BAC of 0.011 - and 28 mg/dl in vitreous fluid)

This report will focus on the pharmacology, pharmacokinetics and toxicology of the blood level of the drugs identified in the Toxicology Report and their potential effects on Mr. Jenkins.

Pharmacology, Pharmacokinetics, and Toxicology of Methamphetamine and Amphetamine

Mr. Jenkins' Blood Levels:
Methamphetamine: 2100 ng/ml
Amphetamine: 64 ng/ml

Methamphetamine, and its metabolite amphetamine, are sympathomimetic amines with central nervous system (CNS) stimulant activity. Their effects are mediated by the action of norepinephrine centrally and peripherally. Methamphetamine was used clinically for the treatment of obesity, narcolepsy and attention deficit hyperactivity disorder (ADHD) until the 1970's.

Methamphetamine is metabolized in the liver to amphetamine, which has some pharmacological effects, but the primary effects are from methamphetamine. The plasma elimination half-life of methamphetamine averages 10 hours (range 6 to 15 hours) and is highly dependent on urinary pH.

Normal or therapeutic doses of methamphetamine produce CNS stimulation as its primary effect. These effects are generally manifested as increased energy, alertness, increased heart rate and blood pressure, restlessness, dizziness, insomnia, and decreased appetite.

An overdose or toxic effects of methamphetamine include confusion, anxiety, agitation, irrational or violent behavior, hallucinations, cardiac arrhythmias, hypertension, hyperthermia, circulatory collapse, convulsions and coma. Chronic abusers may develop paranoid psychosis.

Use of methamphetamine releases a "feel-good" chemical in the brain called dopamine. This chemical causes a rush of euphoria that lasts from five to 30 minutes. When this initial rush ends, methamphetamine users experience an increased sense of well-being, decreased appetite and increased energy. These lingering effects can last from six to 12 hours.

Methamphetamine increases energy levels in the body. This causes the body to think it has unlimited amounts of energy, leading people to avoid sleep and engage in excessive activity. But when the body's energy is depleted, methamphetamine users experience a "crash" or comedown marked by fatigue or extreme exhaustion. Symptoms of a methamphetamine "crash" or comedown include low energy, confusion, intense drug cravings, agitation, anxiety, and suicidal ideation.

Interpreting Blood Levels and Possible Effects of Methamphetamine

It is not possible to determine exactly how much methamphetamine Mr. Jenkins took, when he took it or the specific individual effects it would have on him. However, with the level reported, it is likely that he consumed a significant amount of methamphetamine within a few hours of the incident.

The post-mortem methamphetamine level in Mr. Jenkins was reported at 2100 ng/ml. This closely represents the antemortem level (the level immediately prior to death). However, methamphetamine may exhibit some postmortem redistribution (PMR), which refers to the changes that occur in drug concentrations after death. It involves the redistribution of drugs into blood from solid organs such as the lungs, liver, and myocardium.

According to *Disposition of Toxic Drugs and Chemicals in Man*, 12th edition by Randall C. Baselt, postmortem methamphetamine heart/femoral blood concentration ratios averaged 1.6 when blood was collected at autopsy 5-35 hours later. Thus, the methamphetamine level reported in Mr. Jenkins' heart blood, which is what was reported in this case, may be slightly higher than the antemortem level. The amount of PMR is dependent on how long after death the blood was taken. In this case, Mr. Jenkins was fatality shot at 1049 hours and the autopsy was performed at 1500 hours, or about 5 hours after death. Due to the small amount of time between death and the blood collection, the levels reported in this case are likely not significantly elevated.

Mr. Jenkins' blood levels at autopsy, which would approximate the levels at the time of death, were:

- Methamphetamine: 2100 ng/ml
- Amphetamine: 64 ng/ml

As discussed above, amphetamine is a metabolite of methamphetamine and does not play a clinically significant role in relation to methamphetamine. The level of amphetamine is much less than the level of methamphetamine. Thus, this report will focus on methamphetamine rather than amphetamine.

Drug and chemical blood-level data 2001, by Charles L. Winek, lists the following blood levels for methamphetamine:

- Therapeutic: 10 – 50 ng/ml
  - Therapeutic means the desired level to treat ADHD and narcolepsy
- Toxic: 600 – 5000 ng/ml
- Fatal: >10,000 ng/ml

To illustrate and compare these levels, the following studies done in a controlled environment with a specific dose of methamphetamine are excerpted from *Disposition of Toxic Drugs and Chemicals in Man*, 12th edition by Randall C. Baselt:

- A single oral methamphetamine dose of 0.125 mg/kg (8.75 mg/70 kg) given to 6 adults produced an average peak plasma concentration of 20 ng/ml at 3.6 hours.

- A 30 mg oral dose given to 10 young men resulted in an average peak serum methamphetamine concentration of 95 ng/ml (range 62 - 291 ng/ml) at 3-5 hours.

  - Mr. Jenkins' level of methamphetamine (2100 ng/ml) was 22 times greater than what would be produced by taking therapeutic doses of 30 mg orally.

Baselt, in *Drug Effects on Psychomotor Performance,* reports on an epidemiological study conducted in 1986 that involved the collection of blood specimens from 259 tractor-trailer drivers who stopped at an interstate weigh station in Tennessee and who agreed to participate on a voluntary basis. Three of these had methamphetamine in their blood at concentrations of 50 – 120 ng/ml. Mr. Jenkins was 17.5 to 42 times higher than the methamphetamine level of these 3 persons.

Baselt also reports that blood methamphetamine concentrations averaged 550 ng/ml (range 10 – 1900 ng/ml) in 26 individuals arrested for driving under the influence of the drug. 17 of these subjects were involved in accidents, while the remainder were charged with speeding or erratic driving. Their symptoms included nervousness, rapid speech, confusion, agitation, irrational or violent behavior and unconsciousness. The *average* methamphetamine level in this study was 550 ng/ml. Mr. Jenkins was almost 4 times higher than the level which produced confusion, agitation, irrational or violent behavior.

NMS labs, who performed the toxicology analysis in this case, reports that methamphetamine is capable of causing hallucinations, aggressive behavior and irrational reactions. NMS data indicates that blood levels of 200 – 800 ng/ml have been reported in methamphetamine abusers who exhibited violent and irrational behavior. Mr. Jenkins' level of 2100 ng/ml is 2.6 to 10.5 times higher than these levels.

Conclusions on Methamphetamine

Mr. Jenkins' level of methamphetamine at 2100 ng/ml was 22 times more than what would be considered to be a "therapeutic level" and was in the "toxic" range of 600 – 5000 ng/ml. It was between 2.6 to 10.5 times higher than the level reported to exhibit "violent and irrational behavior" according to NMS labs and Baselt data.

Thus, Mr. Jenkins would be considered to be in the "toxic" range for methamphetamine. As discussed in this report, the expected effects from methamphetamine toxicity include confusion, anxiety, agitation, irrational or violent behavior, hallucinations, cardiac arrhythmias, hypertension, hyperthermia, circulatory collapse, convulsions and coma. Chronic abusers may develop paranoid psychosis.

At a methamphetamine level of 2100 ng/ml, Mr. Jenkins would more likely than not have experienced many of these listed effects, with confusion and violent or irrational behavior very likely to have occurred during the incident.

Pharmacology, Pharmacokinetics, and Toxicology of Ethanol

Mr. Jenkins Level: 11 mg/dl in blood – a BAC of 0.011 g/dl – and 28 mg/dl in vitreous fluid

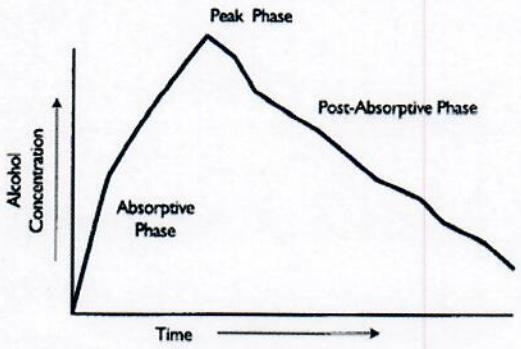
Alcohol (ethyl alcohol, ethanol) is a readily available drug in several dosage forms. Ethyl alcohol is a small, water-soluble molecule that is readily absorbed and distributed by the blood throughout all the water-containing components of the body. It is eliminated from the body by metabolism, excretion and evaporation. The process of alcohol metabolism begins at nearly the same time the alcohol is absorbed and continues until all the alcohol is removed. The measured blood alcohol concentration (BAC) at any time results from the interaction of all these processes.

Ethanol is absorbed rapidly, usually within 30 to 60 minutes. The presence of food produces a minor delay in absorption. The alcohol in beer is more slowly absorbed than alcohol in other types of alcoholic beverages. The metabolism of ethanol is usually 0.01 to 0.03 g/dl per hour, with most people metabolizing in the range of 0.015 to 0.02 g/dl. Metabolism does not correlate with race, age, or time of day.

The time course of absorption is a curve illustrated—excerpted from Borkenstein, R.E., et al., "The Role of the Drinking Driver in Traffic Accidents," Department of Police Administration, Indiana University, 1964— which can be divided into three phases:

1. absorptive phase
2. peak phase
3. post-absorptive phase

General Alcohol Concentration Curve



The duration of each phase, and therefore the shape of an alcohol curve for a given situation, will vary according to any factors that affect the pharmacokinetic processes.

Prediction of Effects/Degree of Ethanol Impairment and Intoxication

Alcohol effects are dose-related. The more alcohol consumed, the greater its effects. Alcohol impairs both cognition (the process of knowing, thinking, learning and judging) and psychomotor skills (voluntary movement). Under most state statutes, including Tennessee, one is considered under the influence of any alcoholic beverage when the person has a blood or breath alcohol level (BAC) of 0.08 g/dl or higher. In this case, Mr. Jenkins' blood alcohol level (BAC) was reported to be 0.011 g/dl. This level is well below the 0.08 g/dl threshold for *per se* intoxication, thus there would be little, if any, significant effects from this level of alcohol.

Conclusions

It is my opinion, to a reasonable degree of scientific, pharmacological, pharmacokinetic and toxicological certainty, that Mr. Jenkins had toxic levels of methamphetamine in his system at the time he was confronted by the police. These toxic effects would likely be manifested by varying degrees of confusion, anxiety, agitation, and irrational or violent behavior.

The small amount of alcohol reported in his blood would not have any significant effects.

Respectfully submitted,

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